

Section 9 Mitigation Action Plan

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9.1 Interim Final Rule Requirement for the Mitigation Action Plan

Requirement §201.6(c)(3): *The plan shall include a mitigation strategy that provides the jurisdiction's blueprint for reducing the potential losses identified in the risk assessment, based on existing authorities, policies, programs and resources, and its ability to expand on and improve these existing tools.*

Requirement §201.6(c)(3)(i): *[The hazard mitigation strategy shall include a] description of mitigation goals to reduce or avoid long-term vulnerabilities to the identified hazards.*

Requirement §201.6(c)(3)(ii): *[The mitigation strategy **shall** include a] section that identifies and analyzes a comprehensive range of specific mitigation actions and projects being considered to reduce the effects of each hazard, with particular emphasis on new and existing buildings and infrastructure. [The mitigation strategy] must also address the jurisdiction's participation in the National Flood Insurance Program (NFIP), and continued compliance with NFIP requirements, as appropriate.*

Requirement: §201.6(c)(3)(iii): *[The mitigation strategy section **shall** include] an action plan describing how the actions identified in section (c)(3)(ii) will be prioritized, implemented, and administered by the local jurisdiction. Prioritization **shall** include a special emphasis on the extent to which benefits are maximized according to a cost benefit review of the proposed projects and their associated costs.*

Requirement §201.6(c)(3)(iv): *For multi-jurisdictional plans, there **must** be identifiable action items specific to the jurisdiction requesting Federal Emergency Management Agency (FEMA) approval or credit of the plan.*

9.2 Mitigation Goals, Objectives, and Actions

This section contains goals, objectives, and action items for the City of Galveston Hazard Mitigation Plan. For the purposes of this Plan, the following definitions are proposed:

- **Goals** are general guidelines that explain what the parish and participating municipalities want to achieve. Goals are expressed as broad policy statements representing desired long-term results.
- **Objectives** (or strategies) describe strategies to attain an identified goal. Objectives are more specific statements than goals; objectives are also usually measurable and can have a defined completion date.
- **Mitigation Actions** are the specific steps (projects, policies, and programs) that advance a given objective. They are highly focused, specific, and measurable.

The hazard identification and risk assessment in Sections 6 and 7 consisted of identifying the hazards that affect the City and the potential for damage to community assets that are vulnerable to the hazards, including historic assets, critical facilities and beaches. Section 8 identified the strengths and weaknesses of state and local capabilities. The goals described below, in Table 9.3.3-1 and following, were established and validated by the City of Galveston Hazard Mitigation Plan Stakeholder Committee (HMPSC) members in response to these assessment results. The Committee members considered the goals described in the 2010 Galveston County Plan Update, as well as examples from other planning efforts, and determined the goals below to meet the mitigation needs and vision of the City of Galveston.

The broad goals of the City of Galveston Hazard Mitigation Plan, as determined by the HMPSC, are as follows:

- Goal 1: Improve education and outreach efforts, specifically to the public, elected officials, municipal employees and local businesses, regarding the potential impacts of hazards and the identification of specific measures that can be taken to reduce those impacts.
- Goal 2: Improve capabilities, coordination and opportunities at the municipal level to plan and implement hazard mitigation projects, programs and activities, especially through the use of GIS, coordination with universities and colleges, and public/private partnerships.
- Goal 3: Develop hazard mitigation policies and programs designed to reduce the impact of natural and human caused hazards to people and property.
- Goal 4: Identify and implement hazard mitigation projects to reduce the impact of hazard events and disasters.

Specific objectives and actions to support these goals are described in Table 9.3.3-1.

9.3 Identification and Analysis of Mitigation Actions

9.3.1 Potential Mitigation Actions

The HMPSC has identified several hazard mitigation actions that would benefit the City. These were identified in the HMPSC meetings, which included input from representatives of governmental organizations, local businesses, and private citizens. These actions were determined after

consideration of a range of possible actions to mitigate the City's vulnerabilities to the hazards profiled in Section 6 of this Plan. The following discussion describes general categories of potential actions, and ways they could benefit the City in mitigating their identified vulnerabilities.

Public Education and Outreach

Insurance industry and emergency management research has demonstrated that awareness of hazards is not enough. People must know how to prepare for, respond to, and take preventive measures against threats from hazards. This research has also shown that a properly run local information program is more effective than national advertising or public campaigns.

Although concerted local and statewide efforts to inform the public exist, lives and property continue to be threatened when segments of the population remain uninformed or chose to ignore the information available. Public education and outreach serves to assist communities with problems experienced from floods, high wind–straight-line winds, severe storm–winter weather, as well as other lower priority hazards. Educating the public of these life and property saving techniques must remain a high priority item at the local, state, and federal levels and is consistent with Goal 1.

National Flood Insurance Program, Floodplain Management, and Building Codes

Improved floodplain management, including land use planning, zoning, and enforcement at the local level can reduce flood related damages for both existing buildings and new development and are consistent with Goal 3. The use of the National Flood Insurance Program (NFIP) is critical to the reduction of future flood damage costs to the taxpayer.

All developments, regardless of the location, require a permit to include buildings, fill, and any other type development. The City of Galveston has the authority to implement and enforce adopted ordinances related to floodplain management, building code and zoning compliance.

The NFIP requires that when the cost of reconstruction, rehabilitation, addition, or other improvements to a building equals or exceeds 50% of the fair market value, then the building must meet the same construction requirements as a new building. Substantially damaged buildings must be brought up to new construction standards. A residence or building damaged so that the cost of repairs equals or exceeds 50% of the structure's fair market value must also be elevated above the Base Flood Elevation (BFE) in flood zones where BFEs are established. This provision applies to the entire jurisdiction of the City of Galveston.

The original Flood Insurance Rate Maps for the City were issued on May 26, 1970. The City of Galveston joined the NFIP on May 07, 1971, and has always been a member community in good standing with the Program.

Within floodplain management as a whole, the education process must play an important role. As noted above, an effective education program should be implemented to show citizens the importance of building codes and ordinances and how cost effective they could be in reducing future damages.

Established through the NFIP, the Community Rating System (CRS) is a program that counties and municipalities can elect to join. Once a community has joined, policy holders in participating

communities receive a discount on their flood insurance premiums. As a result of being part of the CRS, the City would have to actively pursue public outreach programs. One of the requirements of CRS is an annual outreach project, such as a Repetitive Loss Outreach Program. This program would focus on repetitive loss areas within the City and consists of three main components. The first is to advise the homeowners that they live in a repetitive loss area and could be subject to flooding. The second is to give the homeowner appropriate property protection measure guidelines. The third is to make the homeowner aware of the basic facts about Flood Insurance. The City is not currently a member of the CRS, but is considering joining the program in the future.

Each community that is a participating community in the NFIP Program is required to have both a well trained municipal floodplain manager and construction code official. The City currently meets this requirement. To ensure adequate enforcement of both codes, each community in the NFIP should encourage additional training opportunities for all code enforcement personnel, to include its municipal floodplain manager.

Floodplain management and building codes serve to assist the communities with problems experienced from floods, hurricanes, tornadoes, and thunderstorms/lightning/high winds as well as other lower priority hazards.

The City has adopted and currently enforces the International Building Code (IBC), 2006, and is in the process of transitioning to IBC 2009.

Flood Mitigation Actions

Retrofitting structures prone to periodic flooding is an effective mitigation technique to reduce the flood loss of property and is consistent with Goal 4. Techniques include the elevation of structures, acquisition, mitigation reconstruction, dry flood-proofing, wet flood-proofing, drainage improvements, and installation of generators.

Elevation: involves raising a structure on a new foundation so that the lowest floor is above the BFE. Almost any type and size of structure can be elevated.



Acquisition of Structures: the *buyout* option is the most effective mitigation technique to reduce the loss of property due to flooding. The owners of repetitive flood loss or flood damaged structures sell their structure to the community on a cost share basis for the fair market value of the structure prior to the last flood event. The structure is removed and/or demolished and a deed restriction is placed on the property for perpetuity, thus removing the structure from future flood damage. This approach is most effective when flood prone structures located within the same vicinity are grouped together and acquired. The remaining property is converted to open space, and is subject to the building and development limitations outlined in the deed restriction. While the property may be re-developed, it may not be in any manner that impedes the floodplain or violates the terms of the deed restriction.

Dry Flood-proofing: is a mitigation technique designed to prevent floodwaters from penetrating the structure. Techniques include the building of floodwalls adjacent to existing walls, the installation of special doors to seal out floodwaters, and special backflow valves for water and sewer lines. Dry flood-proofing includes low cost mitigation measures such as raising air conditioners, heat pumps, and hot water heaters on platforms above the BFE.

Wet Flood-proofing: is a mitigation technique designed to allow for the safe entry of floodwaters into a structure, thereby minimizing the flood damage to the structure. Generally, this includes properly anchoring the structure, using flood resistant materials below the BFE, protection of mechanical and utility equipment, and use of openings or breakaway walls. Application of wet flood-proofing as a flood protection technique under the NFIP is limited to enclosures below elevated residential and non-residential structures and to accessory and agricultural structures that have been issued variances by the community.

Drainage: Improving the drainage capacity around roads and low-lying areas is a time-tested technique to mitigate flood damage. Maintenance of drainage canals and laterals is essential to maximize their efficiency and continued long term effectiveness. General actions to reduce the effects of flooding include: widening and deepening the earthen canals, cleaning of existing ditches, replacing existing culverts, upgrading pumps, installing check valves and inverts in certain culverts. Maintaining and improving drainage serves to assist the communities with problems experienced from floods, high winds, and severe storms.



Generators: Another cost effective retrofitting technique includes the installation of generators. By providing power with generators during and after severe storms many critical facilities may continue to provide necessary services to the community. The installation of generators serves to assist the communities with problems experienced from floods, high winds, severe storms, earthquakes, and other hazards that typically interrupt power supplies.

Wind Retrofitting Mitigation Actions

Structures can be retrofitted to withstand extreme wind events by installing hurricane shutters, roof tie-downs and other storm protection features. The exterior integrity is maintained by protecting the interior of the structure and providing stability against extreme wind hazards, particularly those associated with hurricanes and tornadoes. These types of measures can be relatively inexpensive and simple to put in place.

Another retrofitting technique is to bury electric power lines to avoid tree limbs from falling on them or from wind damage resulting in a break in service to the consumer. Burying electric power lines serves to assist the communities with problems experienced from extreme winds, tornadoes and severe storms.

Early Warning Systems

With sufficient warning of a flood, a community and its residents can take protective measures such as moving personal property, cars, and people out of harm's way. When a flood threat recognition system is combined with an emergency response plan that addresses the community's flood problems, considerable flood damage can be prevented. This system must be coupled to warning the general public, carrying out appropriate tasks, and coordinating the flood response plan with operators of critical facilities. A comprehensive education and outreach program is critical to the success of early warning systems so that the general public, operators of critical facilities, and emergency response personnel will know what actions to take when warning is disseminated.

Early warning systems serve to assist the communities with problems experienced from floods, extreme winds, severe storms, earthquakes, wildfire, and storm surge.

Coastal Erosion

With a clear understanding of the erosion hazard, communities can work towards preventing future damages. Some mitigating measures are:

Educational Outreach: develop and conduct educational outreach programs on the effects of coastal erosion as well as on how to minimize future erosion.

Erosion Zone Studies: conduct detailed studies to identify erosion hazard zones and provide direction for future coastal development.

Beach and dune restoration projects can also be undertaken as a means to mitigate this hazard.

Wildfire / Urban Fire

The following mitigation measures can be applied to those areas of the community which are designated as fire risk zones.

Educational Outreach: develop and conduct educational outreach programs on wildfire and urban fire prevention including training on fire safe building for contractors and homeowners.

Retrofitting: existing buildings can be retrofitted to reduce their vulnerability to wildfires and urban fires. Potential measures include covering roof vents with wire mesh to prevent entry of embers or flaming debris, and replacing flammable roof materials such as wood or certain types of shingles. Fire resistant roofing materials include various tiles, fiberglass shingles, and single ply membranes.

Safety Zones: safety zones can be created around structures by reducing or eliminating brush, trees, and vegetations around a home or facility. FEMA recommends using a 30' safety zone, including keeping grass below 2" tall and clearing all fallen leaves and branches promptly.

Fire Breaks: roads and trails can be planned so as to serve a dual function as firebreaks. Firebreaks are areas of inflammable materials which create a fuel break and do not allow fires to spread.

9.3.2 Mitigation Actions Identified in Galveston County Plan Update

The 2010 Galveston County Plan Update is an update to the 2005 Houston-Galveston Area Council (HGAC) Plan. The City of Galveston participated in the development processes for both plans. Table 9.3.3-1 lists the actions identified for the City of Galveston in both the 2005 plan and the 2010 Update, and describes their treatment in this Plan. Each previous action was considered and discussed by the Committee. Some actions that were retained were modified to meet the current mitigation needs of the community.

9.3.3 City-Wide Mitigation Actions

The HMPSC developed the following program of mitigation actions in response to the risk and capability assessments (see Sections 7 and 8) that will be implemented on a City-wide basis. These actions are presented in Table 9.3.3-1, and are organized by goal and objective. The actions presented in the table represent both previously identified actions from other planning efforts and newly-identified actions, determined through discussions with the HMPSC and City Staff.

Action items that were included in the 2010 County Update were considered and included by the HMPSC. Such actions are noted as “existing actions” in Table 9.3.3-1. Some actions may have been modified as a result of discussions among the HMPSC members.

Completed actions are indicated by shading. Those actions that were identified in previous planning efforts and are not yet been completed have been deferred. In all cases, these actions were not completed due to one or more of the following circumstances:

- Lack of available funding; or
- Resources otherwise directed towards response and recovery efforts following Hurricane Ike; or
- Interruption in normal operating procedures and scheduled projects following Hurricane Ike.

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**Table 9.3.3-1
City of Galveston –Mitigation Action Plan**

City of Galveston – Mitigation Action Plan								
Proposed Action	Hazard(s) Addressed	New or Existing Action	Estimated Cost	Potential Funding Source(s)	Agency / Department Responsible	Implementation Schedule	Comments	Priority
Goal 1: Improve education and outreach efforts, specifically to the public, elected officials, municipal employees and local businesses, regarding the potential impacts of hazards and the identification of specific measures that can be taken to reduce those impacts.								
Objective 1.1: Educate the public and others on actions they can take to prevent or reduce loss or life or property damage from all hazards.								
Provide hazard and disaster awareness and preparedness information to the public, both residents and visitors.	Biologic Event; Coastal Erosion; Costal Retreat; Coastal Subsidence; Drought; Environmental Disaster; Extreme Wind; Flooding; Hazardous Materials Incident; Lightning; Sea Level Change; Terrorism; Tsunami; Wildfire / Urban Fire	Existing (On-going)	\$2,000	General Fund	Office of Emergency Management	2011-2016 Ongoing annually		High

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Proposed Action	Hazard(s) Addressed	New or Existing Action	Estimated Cost	Potential Funding Source(s)	Agency / Department Responsible	Implementation Schedule	Comments	Priority
<p>Use internet to provide information to residents and visitor regarding natural disasters, preparation and protection.</p> <p>Investigate use of social media to provide information.</p> <p>Maintain use of One Call Reaches All as means of notification and information.</p>	<p>Biologic Event; Coastal Erosion; Coastal Retreat; Coastal Subsidence; Drought; Environmental Disaster; Extreme Wind; Flooding; Hazardous Materials Incident; Lightning; Sea Level Change; Terrorism; Tsunami; Wildfire / Urban Fire</p>	Existing (Modified) (Deferred)	\$5,000	General Fund	Office of Emergency Management	2011-2016 Ongoing annually	This activity is on-going in the aftermath of Hurricane Ike	High
Conduct town meeting prior to start of hurricane season, to provide information to residents.	Extreme Wind; Flooding	Existing (On-going)	\$2,000	General Fund	Office of Emergency Management	2011-2016 Ongoing Annually	This activity occurs annually prior to hurricane season.	High

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Proposed Action	Hazard(s) Addressed	New or Existing Action	Estimated Cost	Potential Funding Source(s)	Agency / Department Responsible	Implementation Schedule	Comments	Priority
Purchase and distribute NOAA All-Hazard radios or other public notification devices to public facilities, schools, day cares, medical facilities, critical facilities, and large public gathering places.	Biologic Event; Coastal Erosion; Coastal Retreat; Coastal Subsidence; Drought; Environmental Disaster; Extreme Wind; Flooding; Hazardous Materials Incident; Lightning; Sea Level Change; Terrorism; Tsunami; Wildfire / Urban Fire	Existing (Modified) (Deferred)	\$100 per unit	FEMA HMGP	Office of Emergency Management	2011-2016	Applies to existing and future development.	High
Implement public information and education campaign to educate residents and businesses about benefits of xerogardening and xeriscaping.	Drought	Existing (Deferred)	\$5,000	General funds, Texas Agriculture Extension Service	Planning and Community Development, Office of Emergency Management	2011-2016	Applies to existing and future development.	High
Implement public information and education campaign to educate residents and businesses about hazardous materials incidents, evacuation procedures in the event of an accident, and sheltering-in-place.	Hazardous Materials Incident	Existing (Deferred)	\$2,500	Private Funds, General funds, FEMA HMGP	Galveston Fire Department, Office of Emergency Management, Public Works	2011-2016		High

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Proposed Action	Hazard(s) Addressed	New or Existing Action	Estimated Cost	Potential Funding Source(s)	Agency / Department Responsible	Implementation Schedule	Comments	Priority
Implement public information and education campaign to educate residents and businesses on how to reduce the threat of urban fires and wildfires.	Wildfire / Urban Fire	Existing (Deferred)	\$2,500	FEMA HMGP, Texas Forest Service, General Funds	Galveston Fire Department, Office of Emergency Management	2011-2016	Applies to existing and future development.	High
Increase on-island CERT capability and capacity.	Biologic Event; Coastal Erosion; Coastal Retreat; Coastal Subsidence; Drought; Environmental Disaster; Extreme Wind; Flooding; Hazardous Materials Incident; Lightning; Sea Level Change; Terrorism; Tsunami; Wildfire / Urban Fire	New	\$5,000	General Funds	Planning and Community Development	2011-2016		Moderate
Goal 2: Improve capabilities, coordination and opportunities at the municipal level to plan and implement hazard mitigation projects, programs and activities, especially through the use of GIS, coordination with universities and colleges, and public/private partnerships.								
Objective 2.1: Acquire and maintain detailed data regarding vulnerabilities, including critical facilities and historic assets, so that these resources can be prioritized and assessed for mitigation actions.								

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Proposed Action	Hazard(s) Addressed	New or Existing Action	Estimated Cost	Potential Funding Source(s)	Agency / Department Responsible	Implementation Schedule	Comments	Priority
Work cooperatively with NOAA and other agencies to conduct workshop/study on sea level rise in Galveston.	Coastal Erosion; Coastal Retreat; Coastal Subsidence; Sea Level Change	New	\$5,000+	General Funds, NOAA	Planning and Community Development	2011-2016		Moderate
Development of Sustainability Plan/Program Implementation.	Biologic Event; Coastal Erosion; Coastal Retreat; Coastal Subsidence; Drought; Environmental Disaster; Extreme Wind; Flooding; Hazardous Materials Incident; Lightning; Sea Level Change; Terrorism; Tsunami; Wildfire / Urban Fire	New	\$125,000	General Funds, CDBG	Planning and Community Development	2011-2016	Applies to existing and future development.	Moderate

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Proposed Action	Hazard(s) Addressed	New or Existing Action	Estimated Cost	Potential Funding Source(s)	Agency / Department Responsible	Implementation Schedule	Comments	Priority
Development of Greenprinting Plan for areas east of West End study.	Biologic Event; Coastal Erosion; Coastal Retreat; Coastal Subsidence; Drought; Environmental Disaster; Extreme Wind; Flooding; Hazardous Materials Incident; Lightning; Sea Level Change; Terrorism; Tsunami; Wildfire / Urban Fire	New	\$5,000	General Funds, Texas Parks and Wildlife, CDBG	Planning and Community Development	2011-2016	"Greenprinting" refers to a strategy to manage growth that ensures quality of life, clean air and water, recreation and economic health. Applies to existing and future development.	Moderate

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Proposed Action	Hazard(s) Addressed	New or Existing Action	Estimated Cost	Potential Funding Source(s)	Agency / Department Responsible	Implementation Schedule	Comments	Priority
Develop proposed land use mapping to allow easier consideration of hazards in future development.	Biologic Event; Coastal Erosion; Coastal Retreat; Coastal Subsidence; Drought; Environmental Disaster; Extreme Wind; Flooding; Hazardous Materials Incident; Lightning; Sea Level Change; Terrorism; Tsunami; Wildfire / Urban Fire	New	\$10,000	General Funds, CDBG	Planning and Community Development	2011-2016	Applies to future development.	Moderate
Consider / Development of structural acquisition plan/procedures.	Flooding	New	\$5,000	General Funds	Planning and Community Development	2011-2016	Applies to existing structures.	Moderate
Consider / Development of structural elevation plan/procedures.	Flooding	New	\$5,000	General Funds	Planning and Community Development	2011-2016	Applies to existing structures.	Moderate
Consider alternative methodologies for determination of substantial damage.	Extreme Wind Flooding Wildfire / Urban Fire	New	\$5,000	General Funds	Planning and Community Development	2011-2016	Applies to existing structures.	Moderate

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Proposed Action	Hazard(s) Addressed	New or Existing Action	Estimated Cost	Potential Funding Source(s)	Agency / Department Responsible	Implementation Schedule	Comments	Priority
Consider / Contract for historic property mitigation study, to determine best practices for mitigation of homes on larger scale.	Biologic Event; Coastal Erosion; Coastal Retreat; Coastal Subsidence; Drought; Environmental Disaster; Extreme Wind; Flooding; Hazardous Materials Incident; Lightning; Sea Level Change; Terrorism; Tsunami; Wildfire / Urban Fire	New	\$50,000	General Funds, THC, GHF, National Park Service, CDBG	Planning and Community Development	2011-2016	Applies to existing structures.	Moderate

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Proposed Action	Hazard(s) Addressed	New or Existing Action	Estimated Cost	Potential Funding Source(s)	Agency / Department Responsible	Implementation Schedule	Comments	Priority
Digitalization of paper records, city-wide, for access post-disaster (mitigate data loss and allow for continuity of operations/government).	Biologic Event; Coastal Erosion; Coastal Retreat; Coastal Subsidence; Drought; Environmental Disaster; Extreme Wind; Flooding; Hazardous Materials Incident; Lightning; Sea Level Change; Terrorism; Tsunami; Wildfire / Urban Fire	New	\$5,000+	General Funds, FEMA HMGP, CDBG	Planning and Community Development, Municipal Utilities, Office of Emergency Management, IT/Finance Department	2011-2016		Moderate

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Proposed Action	Hazard(s) Addressed	New or Existing Action	Estimated Cost	Potential Funding Source(s)	Agency / Department Responsible	Implementation Schedule	Comments	Priority
Develop detailed inventory of critical facilities, to include elevations, square footage and contents inventory.	Biologic Event; Coastal Erosion; Coastal Retreat; Coastal Subsidence; Drought; Environmental Disaster; Extreme Wind; Flooding; Hazardous Materials Incident; Lightning; Sea Level Change; Terrorism; Tsunami; Wildfire / Urban Fire	New	\$5,000	General Funds	Planning and Community Development, Municipal Utilities, Office of Emergency Management	2011-2016	Applies to existing and future development.	High
Goal 3: Develop hazard mitigation policies and programs designed to reduce the impact of natural and human caused hazards to people and property.								
Objective 3.1: Seek ways to reduce losses to the National Flood Insurance Program, and to increase participation in and compliance with the NFIP.								
Consider joining the NFIP's Community Rating System.	Coastal Erosion; Coastal Retreat; Coastal Subsidence; Flooding; Sea Level Change; Tsunami	Existing (On-going))	\$10,000	General Funds	Planning and Community Development	2011-2016	No cost to join program, though administrative costs will be incurred to maintain membership	Moderate

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Proposed Action	Hazard(s) Addressed	New or Existing Action	Estimated Cost	Potential Funding Source(s)	Agency / Department Responsible	Implementation Schedule	Comments	Priority
Consider adoption and enforcement of freeboard requirement into City's Flood Damage Prevention Ordinance.	Coastal Erosion; Coastal Retreat; Coastal Subsidence; Flooding; Sea Level Change; Tsunami	Existing (On-going)	\$2,500	General Funds	Planning and Community Development	2011-2016	Action is currently under consideration for implementation. Would apply to future development and any existing structures designated as substantially damaged or improved.	Moderate
Increase number of floodplain managers in the building division through training and certification.	Coastal Erosion; Coastal Retreat; Coastal Subsidence; Flooding; Sea Level Change; Tsunami	New	\$10,000	General Funds, FEMA	Planning and Community Development	2011-2016		Moderate
Identify Repetitive Loss flooding properties for future mitigation projects.	Flooding; Tsunami	Existing (Complete)	Unknown	General Funds, FEMA	Planning and Community Development	Action Completed	Action has been completed, and will be removed in next Plan update.	Medium
Objective 3.2: Consider measures to ensure that modifications to existing development, as well as any future development, will not put people or property in harm's way, or will not increase threats to existing properties.								
Support aggressive beach nourishment program to address critical erosion areas.	Coastal Erosion; Coastal Retreat; Coastal Subsidence; Extreme Wind; Flooding; Sea Level Change; Tsunami	Existing (Modified) (On-going by GLO)	Unknown	USACE, GLO, CIAP, GLO CEPRA	GLO, Planning and Community Development	2011-2016	This action is on-going in the aftermath of Hurricane Ike.	High

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Restore destroyed dune systems to decrease / mitigate damage to public and private property.	Coastal Erosion; Coastal Retreat; Coastal Subsidence; Extreme Wind; Flooding; Sea Level Change; Tsunami	Existing (On-going by GLO)	Unknown	FEMA HMGP/PDM/FMA, State (CEPRA) and local grants, USACE	GLO, Planning and Community Development	2011-2016	This action is on-going in the aftermath of Hurricane Ike.	High
Install shoreline protection devices in areas subject to coastal erosion to reinforce dune systems.	Coastal Erosion; Coastal Retreat; Coastal Subsidence; Extreme Wind; Flooding; Sea Level Change; Tsunami	Existing (Modified) (Deferred)	\$175,000	FEMA HMGP, USACE, GLO	GLO, Planning and Community Development, Public Works	2011-2016		Moderate
Goal 4: Identify and implement hazard mitigation projects to reduce the impact of hazard events and disasters.								
Objective 4.1: Pursue opportunities to mitigate identified Repetitive Loss and Severe Repetitive Loss properties								
Elevation, acquisition or other mitigation of identified Repetitive Loss and Severe Repetitive Loss properties.	Coastal Erosion; Coastal Retreat; Coastal Subsidence; Extreme Wind; Flooding; Sea Level Change; Tsunami	Existing (Modified) (Deferred)	\$50,000+ (per structure)	CDBG, FEMA HMGP/PDM/FMA/SRL/ RFC, Property Owners, NFIP ICC	Planning and Community Development	2011-2016	Applies to existing structures.	High
Objective 4.2: Pursue opportunities for structural mitigation projects and other projects to protect infrastructure from hazards.								

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Exposed concrete and rebar on public beaches – remove debris and threat to public and private property – reducing property damage during hazard events.	Coastal Erosion; Coastal Retreat; Coastal Subsidence; Extreme Wind; Flooding; Sea Level Change; Tsunami	Existing (Partially Completed)	Unknown	FEMA Public Assistance, GLO, CEPRA, Texas Beach Sweep, CDBG	Public Works	2011-2016	This action is on-going in the aftermath of Hurricane Ike	High
Elevate coastal roads to better protect public during evacuation and to protect the roads from flood damage, where technically feasible.	Coastal Erosion; Coastal Retreat; Coastal Subsidence; Extreme Wind; Flooding; Sea Level Change; Tsunami	Existing (Modified) (Deferred)	Unknown	Potential funding from TXDot, CDBG	FHWA, TXDoT, Public Works	2011-2016 Ongoing project	Applies to existing and future coastal roads.	High
Implement improved drainage projects and better maintenance program for clearing drainage ditches.	Coastal Erosion; Coastal Retreat; Coastal Subsidence; Extreme Wind; Flooding; Sea Level Change; Tsunami	Existing (Modified) (Deferred)	Unknown	TWDB, FEMA HMGP, CDBG, Enterprise Funds	Public Works	2011-2016	Applies to existing and future drainage systems.	High

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Proposed Action	Hazard(s) Addressed	New or Existing Action	Estimated Cost	Potential Funding Source(s)	Agency / Department Responsible	Implementation Schedule	Comments	Priority
Elevation of structures at risk from flooding.	Coastal Erosion; Coastal Retreat; Coastal Subsidence; Extreme Wind; Flooding; Sea Level Change; Tsunami	Existing (Modified) (Deferred)	\$50,000 - \$100,000 (per structure)	CDBG, FEMA HMGP / PDM/ FMA/SRL, Property Owners, NFIP ICC	Planning and Community Development	2011-2016	Will require coordination with TDEM and FEMA to address BCA issues. Applies to existing structures. (Future structures will require elevation to meet current codes/ordinances.)	Moderate
Install security/surveillance equipment at all municipal facilities.	Hazardous Materials Incident; Terrorism	Existing (Modified) (Deferred)	\$100,000	TDEM, DHS, General Funds	Office of Emergency Management	2011-2016	Applies to existing and future development.	High
Purchase text equipment for local cable channel.	Biologic Event; Coastal Erosion; Coastal Retreat; Coastal Subsidence; Drought; Environmental Disaster; Extreme Wind; Flooding; Hazardous Materials Incident; Lightning; Sea Level Change; Terrorism; Tsunami; Wildfire / Urban Fire	Existing (Complete)	\$20,000	FEMA HMGP / PDM	PIO	Action Completed	Action has been completed, and will be removed in next Plan update.	High

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Proposed Action	Hazard(s) Addressed	New or Existing Action	Estimated Cost	Potential Funding Source(s)	Agency / Department Responsible	Implementation Schedule	Comments	Priority
Identify and purchase needed vehicles and equipment for public safety departments.	Biologic Event; Coastal Erosion; Costal Retreat; Coastal Subsidence; Drought; Environmental Disaster; Extreme Wind; Flooding; Hazardous Materials Incident; Lightning; Sea Level Change; Terrorism; Tsunami; Wildfire / Urban Fire	Existing (Modified) (On-going)	\$750,000	FEMA PA, DHS, General Fund, CDBG	Fire Department, Police Department, Public Works, Beach Patrol, Office of Emergency Management	2011-2016	Some equipment and vehicles will be or has been purchased through FEMA PA funding.	High
Harden facility and improve security at 30 th Street Water Pump Station.	Extreme Wind; Flooding; Hazardous Materials Incident; Terrorism	Existing (Complete)	\$235,000	Unknown	Municipal Utilities	Action Completed	Action has been completed, and will be removed in next Plan update.	Moderate

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Proposed Action	Hazard(s) Addressed	New or Existing Action	Estimated Cost	Potential Funding Source(s)	Agency / Department Responsible	Implementation Schedule	Comments	Priority
Harden facility and improve security at unmanned municipal utility facilities.	Biologic Event; Coastal Erosion; Coastal Retreat; Coastal Subsidence; Environmental Disaster; Extreme Wind; Flooding; Hazardous Materials Incident; Sea Level Change; Terrorism	New	\$1,000,000	General Funds, DHS, TWDB, FEMA HMGP/PDM	Municipal Utilities	2011-2016	Action will be dependent on availability of funding, and applies to both existing and future development.	Moderate
Acquisition and demolition of structures damaged by flooding, including abandoned structures.	Coastal Erosion; Coastal Retreat; Coastal Subsidence; Extreme Wind; Flooding; Sea Level Change; Tsunami	Existing (Modified) (On-going)	\$50,000+ (per structure)	CDBG, FEMA HMGP/ PDM/ FMA/ SRL/ RFC, Property Owners, NFIP ICC	Planning and Community Development	2011-2016	Applies to existing structures.	Moderate
Elevation or other flood protection of historic structures at risk from flooding.	Coastal Erosion; Coastal Retreat; Coastal Subsidence; Extreme Wind; Flooding; Sea Level Change; Tsunami	Existing (Modified) (Deferred)	\$50,000+ (per structure)	CDBG, FEMA HMGP/ PDM/ FMA/ SRL/ RFC, Property Owners, NFIP ICC	Planning and Community Development	2011-2016	Applies to existing structures.	Moderate

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Proposed Action	Hazard(s) Addressed	New or Existing Action	Estimated Cost	Potential Funding Source(s)	Agency / Department Responsible	Implementation Schedule	Comments	Priority
Study, evaluate, design and construct flood control methods, with particular emphasis on the protection of critical facilities and critical infrastructure.	Biologic Events; Coastal Erosion; Coastal Retreat; Coastal Subsidence; Environmental Disaster; Extreme Wind; Flooding; Hazardous Materials Incident; Sea Level Change; Tsunami	Existing (Modified) (On-going)	\$50,000+ (per structure or device)	CDBG, FEMA HMGP/ PDM/ FMA, General Fund	Public Works	2011-2016	Applies to existing and future structures.	Moderate
Mitigation/hardening of substantially damaged structures (historic/non-historic).	Extreme Wind; Wildfire / Urban Fire	Existing (Modified) (On-going)	\$50,000+ (per structure)	CDBG, FEMA HMGP/ PDM, Property Owners	Planning and Community Development	2011-2016	Applies to existing and future structures.	Moderate

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Proposed Action	Hazard(s) Addressed	New or Existing Action	Estimated Cost	Potential Funding Source(s)	Agency / Department Responsible	Implementation Schedule	Comments	Priority
Identify critical facilities and other necessary public buildings that require emergency power generation - Purchase and install emergency power generators and related housing and connection equipment at all critical facilities or other necessary public buildings.	Biologic Event; Coastal Erosion; Coastal Retreat; Coastal Subsidence; Drought; Environmental Disaster; Extreme Wind; Flooding; Hazardous Materials Incident; Lightning; Sea Level Change; Terrorism; Tsunami; Wildfire / Urban Fire	Existing (Modified) (On-going)	Unknown	FEMA HMGP, CDBG, General Funds, Enterprise Funds	Office of Emergency Management, Public Works	2011-2016	Some facilities addressed after Ike. Additional facilities to be identified. Applies to existing and future development.	High

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Proposed Action	Hazard(s) Addressed	New or Existing Action	Estimated Cost	Potential Funding Source(s)	Agency / Department Responsible	Implementation Schedule	Comments	Priority
Design and construct a Safe Room (using FEMA 361 design guidance) to house emergency personnel and first responders who must remain on the island during evacuations.	Biologic Event; Coastal Erosion; Coastal Retreat; Coastal Subsidence; Drought; Environmental Disaster; Extreme Wind; Flooding; Hazardous Materials Incident; Lightning; Sea Level Change; Terrorism; Tsunami; Wildfire / Urban Fire	Existing (On-going)	\$25-\$30MM	FEMA HMGP/ PDM, General Funds, Donations, CDBG	Office of Emergency Management, City Manager's Office	2011-2016	Project applied for under DR-1791 HMGP.	Moderate

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Proposed Action	Hazard(s) Addressed	New or Existing Action	Estimated Cost	Potential Funding Source(s)	Agency / Department Responsible	Implementation Schedule	Comments	Priority
Perform retrofits of public utilities (including sanitary sewer and drinking water systems), which may include the following: inflow guards on manhole covers, elevated electrical components, flood proof or elevate utility structures within SFHAs, ring berms around critical facilities that cannot feasibly be elevated, watertight manhole covers, tied down fuel storage tanks.	Biologic Events; Coastal Erosion; Coastal Retreat; Coastal Subsidence; Environmental Disaster; Extreme Wind; Flooding; Hazardous Materials Incident; Lightning; Sea Level Change; Tsunami	Existing (Modified) (On-going)	\$5,000+ per project	FEMA HMGP/ PDM/ FMA, General Funds, TWDB, CDBG	Public Works	2011-2016	Applies to existing structures.	Moderate
Increase native canopy by tree planting in public rights-of-way to reduce urban heat levels.	Drought	Existing (Deferred)	\$10,000	Arbor Day Foundation General Funds, CDBG	Planning and Community Development, Public Works	2011-2016	Applies to existing and future development.	Moderate
Develop and implement a system for early detection / notification of hazardous materials incidents, leaks and accidents.	Hazardous Materials Incident	Existing (Modified) (Deferred)	\$25,000+	Private funding	Galveston Fire Department, Public Works, Office of Emergency Management	2011-2016	Cost would be dependent on material.	Moderate
Investigate eligibility and benefits of National Weather Service's "StormReady" Community program – Apply for entry to program, if beneficial and feasible.	Extreme Wind; Lightning	Existing (Modified) (Deferred)	\$2,500	Private Funds, General funds	Office of Emergency Management	2011-2016		Low

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Proposed Action	Hazard(s) Addressed	New or Existing Action	Estimated Cost	Potential Funding Source(s)	Agency / Department Responsible	Implementation Schedule	Comments	Priority
Wind retrofit critical facilities and those other public buildings that must function following as extreme wind event.	Extreme Wind	Existing (Modified) (On-going)	\$25,000+	FEMA HMGP/ PDM, General Funds, CDBG	Office of Emergency Management, Planning and Community Development, Public Works, City Manager's Office	2011-2016	Project for McGuire Dent Recreation Center submitted under DR-1791 HMGP. Applies to existing structures.	Moderate
Develop and implement stormwater drainage system improvements.	Flooding	Existing (Deferred)	\$25,000	General Funds, Enterprise Funds, TWDB, CDBG	Public Works	2011-2016	Applies to existing and future development.	Moderate
Develop vegetation management program to mitigate spread and fueling of fires.	Wildfire / Urban Fire	Existing (Deferred)	\$5,000	FEMA HMGP/ PDM, Texas Forest Service, General Funds, CDBG	Galveston Fire Department	2011-2016	Applies to existing and future development.	Moderate
Investigate ways to harden and protect facilities and infrastructure belonging to Gulf Coast Water Authority (Sole source provider of potable water to City) – Implement projects as funding becomes available.	Extreme Wind; Flooding; Hazardous Materials Incident; Sea Level Change; Terrorism	New	\$5,000+	General Funds, Enterprise Funds, FEMA HMGP/ PDM, CDBG	Municipal Utilities	2011-2016	Applies to existing and future development.	High

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Proposed Action	Hazard(s) Addressed	New or Existing Action	Estimated Cost	Potential Funding Source(s)	Agency / Department Responsible	Implementation Schedule	Comments	Priority
Rehabilitate the 1894 Bayline, for use as emergency water connection in the event of failure or damage of the water main.	Coastal Erosion; Coastal Retreat; Coastal Subsidence; Extreme Wind; Flooding; Hazardous Materials Incident; Sea Level Change; Terrorism	New	\$15,000,000	General Funds, Enterprise Funds, CDBG FEMA HMGP	Municipal Utilities	2011-2016	Applies to existing equipment/structures.	High
Implement plans for elimination of on-site sewage treatment.	Biologic Event; Coastal Erosion; Coastal Retreat; Coastal Subsidence; Environmental Disaster; Flooding; Sea Level Change; Tsunami	New	\$10,000+ per structure	General Funds, Enterprise Funds, CDBG, Property Owners	Planning and Community Development, Municipal Utilities	2011-2016	Applies to existing structures.	Moderate
Monitor funding sources for opportunities to provide assistance to homeowners for purchase of grinder pumps (maintenance would remain property owner's responsibility).	Biologic Event	New	\$5,000+ per structure	Unknown at this time	Planning and Community Development, Municipal Utilities	2011-2016	Applies to existing structures.	Moderate

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Proposed Action	Hazard(s) Addressed	New or Existing Action	Estimated Cost	Potential Funding Source(s)	Agency / Department Responsible	Implementation Schedule	Comments	Priority
Investigate and implement hardening of IT and phone (communication) infrastructure, to include off-site/remote facilities.	Biologic Event; Coastal Erosion; Coastal Retreat; Coastal Subsidence; Drought; Environmental Disaster; Extreme Wind; Flooding; Hazardous Materials Incident; Lightning; Sea Level Change; Terrorism; Tsunami; Wildfire / Urban Fire	New	\$5,000+	General Funds, FEMA HMGP, CDBG	Planning and Community Development, Municipal Utilities, Office of Emergency Management, IT/Finance Department	2011-2016	Applies to existing and future infrastructure.	High

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Proposed Action	Hazard(s) Addressed	New or Existing Action	Estimated Cost	Potential Funding Source(s)	Agency / Department Responsible	Implementation Schedule	Comments	Priority
Increased capacity/hardening for internal departmental communication.	Biologic Event; Coastal Erosion; Costal Retreat; Coastal Subsidence; Drought; Environmental Disaster; Extreme Wind; Flooding; Hazardous Materials Incident; Lightning; Sea Level Change; Terrorism; Tsunami; Wildfire / Urban Fire	New	\$5,000+	General Funds, FEMA HMGP, CDBG	Planning and Community Development, Municipal Utilities, Office of Emergency Management, IT/Finance Department	2011-2016	Applies to existing and future infrastructure.	High

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Proposed Action	Hazard(s) Addressed	New or Existing Action	Estimated Cost	Potential Funding Source(s)	Agency / Department Responsible	Implementation Schedule	Comments	Priority
Develop a standby application for post-disaster code enforcement (includes building, compliance, planning, public works, etc).	Biologic Event; Coastal Erosion; Coastal Retreat; Coastal Subsidence; Drought; Environmental Disaster; Extreme Wind; Flooding; Hazardous Materials Incident; Lightning; Sea Level Change; Terrorism; Tsunami; Wildfire / Urban Fire	New	\$5,000	General Funds	Planning and Community Development	2011-2016		High

9.4 Prioritization and Implementation of Mitigation Actions

The preceding section identified specific actions to achieve identified goals, an appropriate responsible party for each action, the action's applicability to existing or future development, an estimated cost for each action, a schedule for accomplishment and suggested funding sources. An initial prioritization was also depicted.

Priorities were initially determined on a qualitative basis by the HMPSC. The considerations were general feasibility and anticipated effectiveness in reducing risk. Detailed benefit-cost analyses were not performed (see notes below) but general cost effectiveness of the types of actions being considered was taken into account.

The mitigation action items with highest priority were generally considered to be the most cost effective and most compatible with the community's social and cultural values.

Per the results of the Capability Assessment in Section 8, of particular concern regarding the effective implementation of mitigation actions and strategies is that there is often little to no staffing available at the local level to devote to hazard mitigation related activities, including monitoring for funding opportunities. Staffing, resources, and coordination of effort are at a premium with little chance of significant change to these issues in the foreseeable future. Therefore, the inclusion of any specific action item in this document does not commit the City to implementation. Each item will be considered for implementation in terms of the available staff and funding resources on a periodic basis. In addition, certain items may require regulatory changes or other decisions that must be implemented through standard processes, such as changing regulations.

The method that the HMPSC utilized to help them consider and prioritize potential action items for funding applications at that time in a systematic way is called the *Social, Technical, Administrative, Political, Legal, Economic, and Environmental* (STAPLEE) method. This method, which was also utilized by the State of Texas in the State Mitigation Plan, helped the HMPSC to weigh the pros and cons of different alternatives for each of the identified actions and objectives. Table 9.4-1 describes the basic steps in the STAPLEE methodology.

Table 9.4-1
STAPLEE Methodology
(Source: FEMA 386)

STAPLEE Methodology	
STAPLEE	Criteria Explanation
S-Social	Mitigation actions are acceptable to the community if they do not adversely affect a particular segment of the population, do not cause relocation of lower income people, and if they are compatible with the community's social and cultural values.
T-Technical	Mitigation actions are technically most effective if they provide long-term reduction of losses and have minimal secondary adverse impacts.
A-Administrative	Mitigation actions are easier to implement if the jurisdiction has the necessary staffing and funding.

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STAPLEE Methodology	
STAPLEE	Criteria Explanation
P-Political	Mitigation actions can truly be successful if all stakeholders have been offered an opportunity to participate in the planning process and if there is public support for the action.
L-Legal	It is critical that the jurisdiction or implementing agency have the legal authority to implement and enforce a mitigation action.
E-Economic	Budget constraints can significantly deter the implementation of mitigation actions. Hence, it is important to evaluate whether an action is cost-effective, as determined by a cost benefit review, and possible to fund.
E-Environmental	Sustainable mitigation actions that do not have an adverse effect on the environment, that comply with federal, state, and local environmental regulations, and that are consistent with the community's environmental goals, have mitigation benefits while being environmentally sound.

The HMPSC defined High, Moderate, and Low priorities to be assigned in this process. Values of 1, 2 or 3 were assigned to each of the STAPLEE criteria, with 1 being low or not a concern/impediment to the project, 2 being moderate or a potential concern/impediment, and 3 being high or a likely concern/impediment to the project. A formula was applied to determine the project's overall ranking. Projects with a total STAPLEE score of less than 7 were assigned an overall ranking of Low. Projects with a total STAPLEE score of more than 16 were assigned an overall ranking of High. All other projects were assigned a Moderate priority ranking.

Once funding sources are identified (e.g., via grant announcements from TDEM or FEMA) the list of mitigation actions will be reviewed to select actions that meet the particular grant criteria. Then, priority rankings for the short list of projects will be determined by the responsible department or agency.

Depending on the available grant funding, the HMPSC will determine how many of the selected and prioritized projects should be submitted for funding starting with the highest priority projects as determined at the time.

Benefit-Cost Analysis

Per the IFR, communities are required to use benefit-cost analysis to prioritize projects for implementation. At this stage, the analysis of costs and benefits has been done at a general level. However, as project funding becomes available, the City will undertake a more extensive process.

Benefit-cost analysis (BCA) compares the benefits of mitigation measures to the costs, and is a technique used for evaluating the cost-effectiveness of mitigation measures. FEMA requires a BCA for all mitigation projects that receive FEMA funding.

The HMPSC discussed the potential costs associated with each type of mitigation measure and decided that any project had the potential to be cost effective if its scope were properly tailored to the situation. For example, one of the most effective mitigation measures identified for repetitively

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flooded structures is elevation. It may not be cost effective to elevate every single repetitively flooded structure in the City, but it almost certainly would be cost effective to elevate those that cause the largest drain to the NFIP.

After discussing the possible costs of the various mitigation measures, the HMPSC decided that instead of working on developing a very generic BCA at this time for projects that may not ever be authorized, they would wait until specific funding sources are identified and available. For example, the City and its partners are not financially capable of elevating or acquiring any repetitively flooded structures without federal grant assistance. However, at the time that grants become available (HMGP after disasters, or PDM and FMA grants annually), the City will collect detailed information on each structure that is interested in participating in the grant program and perform a BCA to help rank the structures as part of the STAPLEE process to determine which should receive funding first.